

REMARKS

Claims 49-52, 55-74, 77 and 78 are pending in this application. By this Amendment, claim 77 is amended. Support for the amendments may be found, for example, in the specification at page 1, lines 17-22. No new matter is added.

Entry of the amendments is proper under 37 CFR §1.116 because the amendments: (a) place the application in condition for allowance (for the reasons discussed herein); (b) do not raise any new issue requiring further search and/or consideration (as the amendments amplify issues previously discussed throughout prosecution); (c) satisfy a requirement of form asserted in the previous Office Action; (d) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (e) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

In view of the foregoing amendments and the following remarks, reconsideration and allowance are respectfully requested.

I. Rejection Under 35 U.S.C. §112

The Office Action rejects claim 77 under 35 U.S.C. §112, second paragraph, as being indefinite. By this Amendment, claim 77 is amended to overcome the rejection.

Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

II. Rejection Under 35 U.S.C. §101

The Office Action rejects claim 77 under 35 U.S.C. §101 for being directed to non-statutory subject matter. By this Amendment, claim 77 is amended to overcome the rejection. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

III. Rejections Under 35 U.S.C. §102**A. Office Action's Assertions Regarding Cu Concentration are Incorrect**

In response to the arguments set forth in the January 11, 2010 Amendment, the Office Action, at page 12, acknowledges that the applied references is silent with respect to Cu concentration of a component made of quartz. The Office Action asserts however that because claim 49 recites Cu concentration values of "1 ppb or less" and "10 ppb or less," the claim reads on components made of quartz having zero Cu concentration and, thus, the applied references that are silent with respect to Cu concentration anticipates such claim features. Applicants respectfully disagree.

Applicants discovered the source of the problem solved by the claimed methods. This is part of the "subject matter as a whole" that must be considered by the Examiner in an obviousness analysis. See MPEP §2141.02(III).

Applicants respectfully submit that the Examiner's reasoning discussed above is technically unsound. First, the applied references do not teach that the single crystal growth material has a zero Cu concentration but, rather, teach that Cu concentration was not considered at all. Conventional methods of producing a silicon single crystal, such as the method disclosed in Sakurada, have not considered crystal defects as a result of Cu contamination. See specification at page 27, line 7 - page 36, line 23. Although not recognized by conventional methods, crystal defects as a result of Cu contamination is inevitable during production of silicon single crystals because raw materials and components of an apparatus used for growing silicon single crystals contain Cu. See specification at page 30, line 27 - page 32, line 12. Thus, Cu contamination occurs even though Cu is not intentionally added during the production of silicon single crystals. Thus, the components made of quartz disclosed in the applied references cannot have a Cu concentration of zero, as asserted by the Office Action.

Claim 49 requires very low Cu concentration values of "1 ppb or less" and "10 ppb or less" of the single crystal growth material. Cu concentration that is higher than the recited ranges results in Cu being easily adhered to, and diffused into, the single crystal growth components in ordinary operations. Thus, the cleaning of the components is performed in a highly clean room in which cleanliness in the room environment is of class 1000 or more. In addition to this, Cu contamination of the components, which has conventionally been thought to have insignificant effect on crystal defects, is reduced to the recited range to prevent the occurrence of such crystal defects.

Additionally, in order to modify Cu concentration of the components used to produce silicon single crystals to a value within the ranges recited in claim 49, there must have been a particular problem in the applied references that an ordinarily skilled artisan would set out to resolve, such as crystal defects caused by Cu contamination. The applied references however are completely silent with respect to Cu concentration and, thus, does not disclose a problem associated with high Cu concentration. In fact, an ordinarily skilled artisan would have been discouraged to reduce Cu concentration of the components for producing silicon single crystals to a value recited in claim 49, much less a Cu concentration of zero, because cleaning the components and using quartz components of high purity in order to reduce Cu concentration would result in decreased productivity and increased production costs.

For at least these reasons, an ordinarily skilled artisan would not conclude that Cu concentration of components used to make silicon single crystals in the applied references has a value of zero. Thus, the applied references do not anticipate and would not have rendered obvious the claimed methods for producing a silicon single crystal.

B. Sakurada

The Office Action rejects claims 49-52 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application Publication No. 2003/0116082 to Sakurada et al. ("Sakurada").

Applicants respectfully traverse the rejection.

Claim 49 requires that the "Cu concentration in a component made of quartz to be used in a part in which a temperature in a furnace for single crystal growth is 1000°C or more is 1 ppb or less, and Cu concentration in a component made of quartz to be used in a part in which a temperature in the furnace for single crystal growth is less than 1000°C is 10 ppb or less." As a result of such features, silicon single crystals of high quality can be produced because Cu contamination in the single crystal growth is reduced and Cu precipitates can be prevented. See specification, page 10, line 18 - page 13, line 5.

Sakurada does not disclose such claim features. Instead, as described above, Sakurada is completely silent with respect to Cu concentration of components made of quartz, much less a Cu concentration of "1 ppb or less" or "10 ppb or less." In addition, the quartz components of Sakurada necessarily have a Cu concentration significantly greater than 10 ppb.

Thus, Sakurada does not anticipate claim 49. Claims 50-52 depend from claim 49 and, thus, also are not anticipated by Sakurada for at least the same reasons. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Oda

The Office Action rejects claims 49, 50 and 55-64 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application Publication No. 2003/0000457 to Oda et al. ("Oda"). Applicants respectfully traverse the rejection.

As discussed above, claim 49 requires a Cu concentration of "1 ppb or less" or "10 ppb or less." Oda does not disclose these claim features. Instead, Oda is completely silent

with respect to Cu concentration of components made of quartz, much less a Cu concentration of "1 ppb or less" or "10 ppb or less." In addition, the quartz components of Oda necessarily have a Cu concentration significantly greater than 10 ppb.

Thus, Oda does not anticipate claim 49. Claims 50 and 55-64 depend from claim 49 and, thus, also are not anticipated by Oda for at least the same reasons. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

IV. Rejection Under 35 U.S.C. §§102/103

The Office Action rejects claim 74 under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as having been obvious over Oda. Applicants respectfully traverse the rejection.

The Office Action, on pages 7-8, asserts that Oda discloses a clean room at a class 1000 setting for the growth, processing and manufacturing of silicon single crystal material. The Office Action further asserts that it would have been obvious to an ordinarily skilled artisan to transfer components to another room having cleanliness at class 1000 or more based on the plurality of operation floors disclosed in Oda. Applicants respectfully disagree.

Claim 74 requires cleaning in-furnace components by taking out the in-furnace components, transferring the in-furnace components to another room where the cleaning is performed and maintaining the cleanliness at class 1000 or more. Oda does not disclose and would not have rendered obvious such claim features.

Oda teaches that cleaning of the inside of the furnace body occurs in an intermediate story where the cleanness is degraded to about class 10,000 during the cleaning operation. See paragraphs [0027] and [0040]. Oda further discloses that the cleaning operation does not affect the uppermost floor at all, thereby maintaining the high degree of cleanness in the uppermost floor. See paragraph [0040]. Thus, Oda does not teach that the in-furnace components are cleaned in another room while maintaining the cleanliness in the room

environment to be class 1000 or more because Oda teaches that the cleaning operation occurs in the intermediate story where the degree of cleanness is degraded to about class 10,000.

Furthermore, an ordinarily skilled artisan would not have reasonably concluded that the furnace body components could or should have been transferred to another room having cleanliness at class 1000 or more based on the plurality of operation floors disclosed in Oda. As indicated above, the cleaning operation of the inside of the furnace body occurs in the intermediate story and does not affect the uppermost floor at all. At most, Oda teaches the step of cleaning the inside of the pulling apparatuses, accompanied by dusting, which is provided in the intermediate story. See paragraph [0027]. Thus, based on the teachings of Oda, an ordinarily skilled artisan would not have reasonably concluded that the furnace body components could or should have been taken out and transferred to another room to perform the cleaning operation.

Thus, Oda does not anticipate and would not have rendered obvious claim 74. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

V. Rejection Under 35 U.S.C. §103

A. Oda and Holder

The Office Action rejects claims 65-73 and 78 under 35 U.S.C. §103(a) as having been obvious over Oda in view of U.S. Patent No. 6,344,083 to Holder ("Holder").

Applicants respectfully traverse the rejection.

1. Claims 65-72

Claims 65-72 variously depend from claim 49 and, thus, contains all of the features of claim 49. Deficiencies of Oda with respect to claim 49 are discussed above. Holder, which is applied by the Office Action for the additional features recited in claims 65-72, does not cure deficiencies of Oda with respect to claim 49.

Thus, Oda and Holder would not have rendered obvious claims 65-72.

2. Claims 73 and 78

Claims 73 and 78 are directed to methods of producing a silicon single crystal where "after melting of a silicon raw material is finished, it is left for 3 hours or more on a condition that a heating heater is heated with an electric power of 80% or more...." The claimed method provides high-quality silicon single crystals without any Cu precipitates because Cu removed from the HZ components are exhausted out of the furnace and the silicon single crystal is grown thereafter, thereby reducing Cu contamination. See specification at page 19, line 19 - page 20, line 13.

As discussed in the January 11, 2010 Amendment, Holder does not disclose that the silicon single crystal is left for 3 hours or more in a heater after melting of a silicon raw material is finished. Instead, Holder teaches that the melting and equilibration process takes about 3.5 hours. See Holder, Example. This time period is the total time at which the silicon composition is melted and equilibrated, and not the time period at which the silicon single crystal is left in a heater after melting of the silicon raw material. Applicants re-assert this argument because the Office Action does not address it and merely asserts that it would have been obvious for an ordinarily skilled artisan to combine Oda and Holder to ensure an appropriate and defect free fabrication of silicon single crystalline ingots for appropriate and efficient use in the microelectronic industry. See Office Action, page 9.

Furthermore, with respect to the electric power setting, the Office Action asserts that the recited electric power setting of 80% or more would have been obvious because an ordinarily skilled artisan would have easily modified power settings based on desired results for achieving optimal conditions. However, neither the Office Action nor Holder establishes that the electric power setting is a parameter of a heating heater that is tolerable for optimum performance to clean the HZ components to the extent that Cu precipitates are not formed in the single crystal. See specification at page 18, lines 3-18. Thus, the Office Action does not

establish, and Holder does not indicate, that the electric power setting is a result-effective variable.

Thus, Oda and Holder would not have rendered obvious claims 73 and 78.

3. Conclusion

For at least these, the applied references would not have rendered obvious claims 65-73 and 78. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Oda and Tsuji

The Office Action rejects claim 77 under 35 U.S.C. §103(a) as having been obvious over Oda in view of U.S. Patent No. 6,068,699 to Tsuji et al. ("Tsuji"). Applicants respectfully traverse the rejection.

Claim 77 is directed to a method for producing a silicon single crystal by using an apparatus having two or more of: (1) Cu concentration of 1 ppb or less in a quartz component where a temperature in a furnace is 1000°C or more and 10 ppb or less in a quartz component where a temperature in a furnace is less than 1000°C, (2) devices and components being exposed in the furnace for a single crystal growth that do not contain Cu as a raw material, and (3) Cu concentration in an observation window of 10 ppb or less. As discussed above, Oda does not disclose a Cu concentration of "1 ppb or less" or "10 ppb or less." Tsuji also fails to disclose such features and, thus, the applied references would not have rendered obvious claim 77.

Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

VI. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Date: June 24, 2010

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